

## TABLE OF CONTENTS

Personnel	v
Publications and Reports	viii
I. Physical Electronics	1
Electron Emission Problems	1
Temperature Dependence of the Fermi Level and Its Relation to Properties of Oxide Cathodes	1
Physical Electronics in the Solid State	2
Hall Effect in Lead Sulfide Films	2
Surface Studies on Semiconductors	3
Electrical Properties of Clean Germanium Surfaces	3
Gaseous Discharges	5
Probe Measurements, Distribution Functions, and the Einstein Relation	5
Experimental Techniques	8
Growing Large Single Crystals in Tantalum Ribbon	8
Use of Single Crystals in Directly Heated Tantalum Ribbon to Determine Work-Functions	9
Evaporated Molybdenum as a Getter	9
Clean-Up of Helium in Ionization Gauges	10
Harmonic Analysis Applied to Thermionic Emission Studies	10
II. Microwave Gaseous Discharges	11
Plasma Oscillations	11
High-Density Microwave Gaseous Discharge	14
Microwave Determination of the Probability of Collision of Slow Electrons in Neon	14
Transition from Free to Ambipolar Diffusion	16
Microwave Breakdown of Ammonia	18
III. Low Temperature Physics	21
Attenuation of Sound in Liquid Helium	21
IV. Microwave Spectroscopy	23
Interactions Between Torsional and Over-All Rotations in Symmetric Top Molecules	23
Paramagnetic Resonance	24
V. Microwave Electronics	25
Experimental Determination of the Longitudinal Intrinsic Emission Noise Characteristics of an Electron Beam at Microwave Frequencies	25
Klystron Amplifier Noise Figure	33
Microwave Noise Measurements with a Radiometer	33

## CONTENTS

VI.	Atomic Beams	38
	Theory of Atomic Hyperfine Structure	38
VII.	Statistical Communication Theory	41
	A Theorem Concerning Noise Figures	41
	An Extension of the Wiener Theory of Nonlinear Systems	43
	Properties of Second-Order Autocorrelation Functions	49
	An Analog Probability Density Analyzer	58
VIII.	Processing and Transmission of Information	60
	Logical Device for Smoothing of Binary Signals	60
	Some Remarks on Scattering from Eddies	61
	A Discussion of Rates for Randomly Varying Channels, Including an Unsolved Case	61
IX.	Transistor Circuits	70
	Voltage-Regulated Power Supplies	70
	A Microscopic Interpretation of Power Gain in Junction Transistors	71
X.	Semiconductor Noise	75
	1/f Noise in Germanium	75
XI.	Communications Biophysics	76
	Changes in Cortical Click Responses as a Function of Click Intensity and Depth of Anesthesia	76
	An Electronic Device for the Detection of Evoked Responses in Potentials Recorded from the Skull	79
XII.	Nonlinear Circuits	82
	Piecewise Linear Network Theory	82
XIII.	Network Synthesis	84
	Voltage Transfer Functions – Grounded Symmetrical Networks	84